

PATENT ABSTRACTS OF JAPAN

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063945

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(54) MANUFACTURING METHOD OF SURFACE ACOUSTIC WAVE DEVICE
AND MULTI-CHAMFER BASE BOARD

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a manufacturing method of a surface acoustic wave device with high reliability of a resin sealed package.

SOLUTION: A plurality of chips on which surface acoustic wave elements are formed are prepared, a plurality of the chips are electrically and mechanically connected on a main surface of a planar base board part, a ring-shaped frame that surrounds around a plurality of the chips is arranged on the main surface of the base board part, a plurality of the chips are sealed by seal resin having

fluidity and the seal resin and the base board part are made into individual fragments by every chip.

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CLAIMS

[Claim(s)]

[Claim 1] Two or more chips with which the surface acoustic element was formed are prepared. Said two or more chips It connects electrically and mechanically on the main front face of the plate-like base substrate section. On the main front face of said base substrate section The manufacture approach of the surface acoustic wave equipment characterized by arranging the frame of the shape of a ring which encloses the perimeter of two or more of said chips, closing said two or more chips by the closure resin which has a fluidity, and piece[of an individual]-izing said closure resin and said base substrate section for said every chip.

[Claim 2] Prepare two or more chips with which the surface acoustic element was formed, and the multiple picking base substrate which has the frame of the shape of a ring arranged on the main front face of the plate-like base substrate section and the base substrate section concerned is prepared. Said two or more chips are connected electrically and mechanically on said main front face of said base substrate section inside said frame. The manufacture approach of the surface acoustic wave equipment characterized by closing said two or more chips by the closure resin which has a fluidity, and piece[of an individual]-izing said closure resin and said base substrate section for said every chip.

[Claim 3] The inner circumference of said frame is the manufacture approach of surface acoustic wave equipment claim 1 characterized by being arranged by one chip from the edge of said chip of the outermost periphery before an outside, and given in claim 2 any 1 term.

[Claim 4] The height of said frame is the manufacture approach of surface acoustic wave equipment claim 1 characterized by being higher than the height of said chip connected to said base substrate section 50 micrometers or more, and given in claim 2 any 1 term.

[Claim 5] It is the manufacture approach of surface acoustic wave equipment claim 1 characterized by being piercing said closure resin and said base substrate section using a razor-like cutting edge, and given in claim 2 any 1 term to piece[of an individual]-ize said closure resin and said base substrate section for said every chip.

[Claim 6] The manufacture approach of surface acoustic wave equipment claim 1 characterized by closing said two or more chips in a reduced pressure ambient atmosphere, and given in claim 2 any 1 term.

[Claim 7] Said closure resin is the manufacture approach of surface acoustic wave equipment claim 1 characterized by having a transparent layer at least in a part, and given in claim 2 any 1 term.

[Claim 8] The multiple picking base substrate characterized by having the frame of the shape of a ring which encloses the perimeter of two or more of said chips arranged on the main front face of the plate-like base substrate section to which two or more chips with which the surface acoustic element was formed are connected electrically and mechanically, and the base substrate section concerned.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention is concerned with the manufacture approach of surface acoustic wave equipment, and a multiple picking base substrate, and relates to the manufacture approach of the surface acoustic wave equipment using the multiple picking base substrate for carrying out the resin seal of two or more chips to coincidence especially.

[0002]

[Description of the Prior Art] In recent years, surface acoustic wave equipment is broadly used as components, such as a filter in the electronic equipment which uses an electric wave, the delay line, and an oscillator. In fields, such as mobile communications, the miniaturization and high-reliability-izing of electronic equipment which are used are required, and there is the same demand also to surface acoustic wave equipment.

[0003] Conventional surface acoustic wave equipment adopts flip-chip-bonding structure and resin seal structure in order to reply to the demand of this miniaturization. Moreover, the manufacture approach which carries out bonding of two or more chips on one base substrate, and carries out a resin seal to coincidence from viewpoints, such as productive efficiency, is adopted.

[0004] As shown in drawing 5 (a), two or more chips 26 with which the surface acoustic element was formed are connected electrically and mechanically on the base substrate 27 of multiple picking through a bump. And two or more chips 26 are closed to coincidence with closure resin 29 by pressing against two or more chips 26 the closure resin 29 of the shape of a sheet which has a fluidity. Surface acoustic wave equipment is manufactured by piece[of an individual]-izing the closure resin 29 which applies and stiffened heat, and the base substrate 27 of multiple picking.

[0005]

[Problem(s) to be Solved by the Invention] Although the surface-acoustic-waves

equipment manufactured by the above-mentioned approach is cheap and it is rich in mass production method, the dependability of a resin seal package is low and it has the problem that the incidence rate of the poor closure is high.

[0006] Since closure resin 29 has a fluidity, before carrying out heat curing, some closure resin 29 will flow and it will fall from the periphery of the multiple picking base substrate 27. That is, as shown in drawing 5 (b), sufficient resin 29 has stopped at the upper part of chip 26a located in the center of the multiple picking base substrate 27. However, the resin 29 which should stop at the upper part of chip 26b located in the outermost periphery will flow and fall from the multiple picking base substrate 27. Therefore, the thickness of the closure resin 29 formed in the periphery section of the multiple picking base substrate 27 will become thin compared with it of a center section. Furthermore, a part of upper part of chip 26b located in the outermost periphery may be exposed.

[0007] Accomplishing this invention in order to solve the trouble of such a conventional technique, the purpose is offering the manufacture approach of surface acoustic wave equipment with the high dependability of a resin seal package, and a multiple picking base substrate.

[0008]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, the 1st description of this invention Prepare two or more chips with which the surface acoustic element was formed, and two or more chips are connected electrically and mechanically on the main front face of the plate-like base substrate section. It is the manufacture approach of the surface acoustic wave equipment which arranges the frame of the shape of a ring which encloses the perimeter of two or more chips, closes two or more chips by the closure resin which has a fluidity, and piece[of an individual]-izes closure resin and the base substrate section for every chip on the main front face of the base substrate section.

[0009] The 2nd description of this invention prepares two or more chips with which the surface acoustic element was formed, respectively. The multiple

picking base substrate which has the frame of the shape of a ring arranged on the main front face of the plate-like base substrate section and the base substrate section is prepared. It is the manufacture approach of the surface acoustic wave equipment which connects two or more chips electrically and mechanically on the main front face of the base substrate section inside a frame, closes two or more chips by the closure resin which has a fluidity, and piece[of an individual]-izes closure resin and the base substrate section for every chip.

[0010] According to the description of this invention, a frame can suppress that closure resin flows and falls from the base substrate section. Therefore, the thickness of the closure resin formed in the upper part of the chip located in the outermost periphery is maintainable on a par with it of a chip which is located in the center.

[0011] As for the inner circumference of a frame, in the description of this invention, it is desirable to be arranged by one chip from the edge of the chip of the outermost periphery before an outside. When this has a not much large distance from the edge of the chip of the inner circumference of a frame, and the outermost periphery, it is because it is hard coming to make thickness of the closure resin formed in the upper part of the chip located in the outermost periphery by the flow of the closure resin to an outside [edge / of the chip of the outermost periphery at the time of the closure] becoming large into it of a chip and the EQC which are located in a center section. However, if a sufficiently bigger thing (large thing) than the magnitude of the whole chip located in the outermost periphery in the magnitude of the closure resin in front of the closure is used, the effectiveness of only a frame is also enough, but it is not desirable on industry in order to use many closure resin which is not contributed to the closure of a chip. From said reason, distance from the edge of the chip of the inner circumference of a desirable frame and the outermost periphery was made desirable [being arranged by one chip before an outside].

[0012] Moreover, it is more desirable than the height of the chip for which the height of a frame was connected to the base substrate section to make it high 50

micrometers or more. This is because it becomes possible to prevent enough exsorption of the outside the limit of the closure resin at the time of the closure.

[0013] Furthermore, as for piece[of an individual]-izing closure resin and the base substrate section for every chip, it is desirable that it is piercing closure resin and the base substrate section using a razor-like cutting edge. This is because it becomes possible cutting and to piece[of an individual]-ize, without applying excessive stress to a chip with a precision sufficient [closure resin and a base substrate].

[0014] Furthermore, in a reduced pressure ambient atmosphere, it is desirable to close two or more chips. This is because it becomes possible to obtain sufficient closure since the space section formed between a chip and a base substrate after the closure can be closed in a reduced pressure ambient atmosphere, and to prevent property degradation of a chip while preventing generating of a void.

[0015] Furthermore, as for closure resin, it is desirable to have a transparent layer at least in a part. If this has the transparent layer to closure resin, in case it will inspect a chip, **, etc. of the chip by which the closure was carried out or will perform failure analysis, it is because internal observation becomes easy.

[0016] The 3rd description of this invention is the multiple picking base substrate which has the frame of the shape of a ring which encloses the perimeter of two or more chips arranged on the main front face of the plate-like base substrate section to which two or more chips with which the surface acoustic element was formed are connected electrically and mechanically, and the base substrate section.

[0017]

[Embodiment of the Invention] With reference to a drawing, the gestalt of operation of this invention is explained below. In the publication of a drawing, the sign identically the same into a similar part or similar is attached. However, a drawing is typical and it should care about that the ratio of the relation between the thickness of a layer and width of face and the thickness of each class etc. differs from an actual thing. Moreover, of course, the part from which the relation

and the ratio of a mutual dimension differ also in between drawings is contained.

[0018] As shown in drawing 1 (a), the surface acoustic wave equipment concerning the gestalt of operation of this invention has the chip 6 which has the ctenidium electrode 5 at least and the closure resin 3 which closes a chip 6 arranged above the plate-like base substrate section 4 and the plate-like base substrate section 4, and two or more projection electrodes 2 which connect between chips 6 with the base substrate section 4 electrically and mechanically. a chip 6 -- the base substrate 4 -- it is mostly arranged in the center.

[0019] As shown in drawing 1 (b) of the cutting plane cut in the A-A' cross section of drawing 1 (a), the projection electrode 2 has been arranged between the base substrate section 4 and a chip 6, and has connected both. Closure resin 3 is arranged also on the top face of a chip 6, and its side face.

[0020] Closure resin 3 has the function to protect a chip 6 from environmental stress and mechanical stress. As closure resin 3, for example, polyimide resin, a PP/EPR system polymer alloy (PP/Ethylene Propylene Rubber Blend), TEX (the Tonen Chemical, Inc. make, polyolefine system TPE (Polyolefine Thermoplastic Elastomer)), Tough PUREN (the Asahi Chemical Co., Ltd. make, SBS (Styrene-Butadiene-Styrene Block Copolymer)), MAKUSUROIA (Japan Synthetic Rubber Co., Ltd. make) and X-9 (the Unitika, Ltd. make --) Macromolecule system ingredients, such as PA/PAR (PA/Polyarylate) and TENAKKU (the Asahi Chemical Co., Ltd. make, POM/TPU (POM/Thermoplastic Polyurethane)), can be used. In the gestalt of operation, resin transparent and colorless as closure resin 3 is used.

[0021] The flexible substrate made from one or more giant-molecule system ingredients chosen from a ceramic substrate or bismaleimide triazine, polyimide (BT resin), polyimide, and polyphenylene ether as the base substrate section 4 can be used. Moreover, although Au bump who uses gold (Au) as a principal component as a projection electrode 2 is used, it is also possible to use the pewter ball of a tin-lead (SnPb) system instead of Au bump. Although the thickness of the base substrate section 4 is not specified at all if it has required

reinforcement, it is desirable that they are 100 thru/or 200 micrometers. In the gestalt of operation, as the base substrate section 4, if it is BT resin with a thickness of 180 micrometers, the flexible substrate which changes is used.

[0022] The surface acoustic element which has the piezoelectric substrate 1 and a metal membrane pattern containing the ctenidium electrode 5 formed on the principal plane of the piezoelectric substrate 1 is formed in the chip 6. Moreover, the metal membrane pattern is formed on the principal plane which counters the base substrate section 4 of the piezoelectric substrate 1. That is, surface acoustic wave equipment has flip-chip-bonding structure. Although the ctenidium electrode 5 omits illustration, it is a metal electrode which has the flat-surface configuration of the shape of two or more ctenidium of gearing mutually. A surface acoustic wave (SAW) is excited and detected by the ctenidium electrode 5. An electrical signal is impressed to the input INTADEJITARU transducer of the ctenidium electrode 5, this is changed into a surface acoustic wave, and the piezoelectric substrate 1 top is made to transmit. The surface acoustic wave which furthermore reached the output INTADEJITARU transducer of another ctenidium electrode 5 is again changed into an electrical signal, and can be taken out outside. The metal used as the ingredient of the ctenidium electrode 5 consists of an alloy which uses aluminum (aluminum) or aluminum as a principal component. In the case of the latter, copper (Cu), silicon (Si), etc. can be used as an additive. In addition, the reflector for reflecting the electrode pad connected to the projection electrode 2 other than the ctenidium electrode 5 and a surface acoustic wave etc. is contained in a metal membrane pattern.

[0023] The electrical signal impressed to an input INTADEJITARU transducer and the electrical signal again transformed into the electrical signal by the output INTADEJITARU transducer are inputted from the base substrate section 4 through the projection electrode 2, respectively, or is outputted to the base substrate section 4. Although illustration was omitted, wiring connected mutually is formed also in the front rear face of the base substrate section 4, and transmission and reception of an electrical signal are performed through this

wiring. Moreover, closure resin 3 is not arranged around the ctenidium electrode 5. The hollow field is formed in the active area of a chip 6 in which the ctenidium electrode 5 was formed. This is for enabling it to perform normally the propagation on excitation of the surface acoustic wave by the ctenidium electrode 5, detection, and the piezoelectric substrate 1 of a surface acoustic wave.

[0024] As a piezoelectric substrate 1, the single crystal substrate which consists of lithium tantalate (LiTaO_3), lithium niobate (LiNbO_3), a barium acid lithium substrate (LiB_4O_7), sapphire, or a quartz watch (SiO_2) can be used. Or it is also possible to replace with these single crystal substrates and to use the electrostrictive ceramics substrate which consists of lead titanate (PbTiO_3), titanate-acid lead zirconate (PbZrTiO_3 (PZT)), or these solid solutions.

[0025] The surface acoustic wave equipment shown in drawing 1 (a) and (b) can be manufactured with the procedure shown in the following shown as an example.

[0026] (b) First, as shown in drawing 2 (a), form the metal membrane of about 100nm of thickness numbers on the piezoelectric wafer-like substrate 1. The resist film is formed on this metal membrane, and the resist film is exposed and developed by the photolithography method. and this resist film -- a mask -- carrying out -- a metal membrane -- reactive ion etching (RIE) -- it etches alternatively by law and the metal membrane pattern containing the ctenidium electrode 5 is formed. membrane formation of a metal membrane -- metal vacuum deposition, the sputtering method, and chemical vapor growth (CVD) -- law can be used.

[0027] (b) Next, as shown in drawing 2 (b), on the electrode pad of a metal membrane pattern, use bump bonding equipment and form the projection electrode 2.

[0028] (c) Next, as shown in drawing 2 (c), use dicing equipment and manufacture cutting 6, i.e., the chip which it piece[of an individual]-izes and is plurality, for every surface acoustic element for the piezoelectric wafer-like

substrate 1.

[0029] (d) Next, as shown in drawing 3 (b) of the cutting plane cut in the B-B' cross section of drawing 3 (a) and drawing 3 (a), prepare many picking base substrates (7 8). It has the frame 8 of the shape of a ring which encloses the perimeter of two or more chips 6 arranged on the main front face of the plate-like base substrate section 7 connected electrically [a picking base substrate (7 8) / two or more chips 6] and mechanically and the base substrate section 7.

[much] Here, two or more "base substrate sections 4" which "the base substrate section 7" showed the substrate for taking much surface acoustic wave equipments, and was shown in drawing 1 (a) and (b) is really formed continuously. Therefore, thickness and an ingredient are the same as the base substrate section 4.

[0030] The inner circumference of a frame 8 is arranged in the location separated from the edge (mounting area of two or more chips 6) of the chip 6 of the outermost periphery 1mm outside. As for the inner circumference of a frame 8, it is desirable to be arranged by one chip from the edge of the chip 6 of the outermost periphery before an outside. The height of a frame 8 is 500 micrometers and width of face is 10mm. Many picking base substrates (7 8) are created by carrying out the laminating of the base substrate section 7 and the frame 8, and pasting up.

[0031] (e) Next, connect two or more chips 1 through the projection electrode 2 using flip-chip-bonding equipment on a multiple picking base substrate (7 8). Here, about 400 chips 6 are connected on one multiple picking base substrate (7 8). Specifically, both are joined by impressing a supersonic wave to the projection electrode 2 and the base substrate section 7 at the same time it presses a chip 6 by the predetermined pressure to the main front face of the base substrate section 7. A chip 6 and the base substrate section 7 are connected electrically and mechanically through the projection electrode 2. As for the height (500 micrometers) of a frame 8, it is desirable to set up suitably by the thing according to the height of the connected chip 6. Specifically, it is more

desirable than the height of the chip 6 for which the height of a frame 8 was connected to the base substrate section 7 to set up highly 50 micrometers or more. In addition, as mentioned above, the chip 6 of the outermost periphery is arranged in the location separated from the inner circumference of a frame 8 1mm to the inside.

[0032] (**) Next, as shown in drawing 4 (a), close to coincidence two or more chips 6 by the closure resin 3 which has a fluidity in a reduced pressure ambient atmosphere. Specifically, sheet-like closure resin 3 is arranged after a chip 6. And the force is applied so that closure resin 3 and the base substrate section 7 may be inserted, and heat is applied to closure resin 3 at coincidence. Closure resin 3 enters the clearance between the adjoining chips 6, and the side face can also be covered and surrounded with closure resin 3 only after a chip 6. Since closure resin 3 contains a heat-curing component, it is hardened with the applied heat. Thus, two or more chips 6 can be closed to coincidence with closure resin 3.

[0033] In addition, sheet-like closure resin 3 becomes possible [preventing more generating of the void of chip 6 side face after the closure as it is not the magnitude of the mounting area of a chip 6 but is the magnitude of extent concerning the upper part of a frame], and is desirable.

[0034] Here, closure resin 3 has an adhesive property. the height (500 micrometers) of a frame -- until -- the height of closure resin 3 can be set to 500 micrometers uniform about all the chips 6 by pressing closure resin 3 using predetermined metal mold. Therefore, the base substrate section 7 and the whole closure resin 3 thickness are set to 680 micrometers.

[0035] in the above-mentioned example, as closure resin 3 before closure processing, although the sheet-like thing was used, it is possible not only this but to harden a top face after arranging resin with a fluidity in [whole] a frame 8, according to the height of a frame, by a squeegee etc., the side and after it is alike and carrying out, and to close two or more chips 6 to coincidence with closure resin 3.

[0036] (**) -- finally, as shown in drawing 4 (b), the base substrate section 7 and

closure resin 3 are piece[of an individual]-ized every chip 6. Here, it piece[of an individual]-izes by pressing a razor-like cutting edge against closure resin 3 or the base substrate section 7, and piercing with a press. Of course, dicing may be carried out using rotary teeth (dicing blade). The surface acoustic wave equipment shown in drawing 1 (a) and (b) can be manufactured through the above procedure.

[0037] As explained above, according to the gestalt of operation of this invention, a frame 8 can suppress that closure resin 3 flows and falls from the base substrate section 7. Therefore, the thickness of the closure resin 3 formed in the upper part of the chip 6 located in the outermost periphery is maintainable on a par with it of a chip 6 which is located in the center.

[0038] moreover, while it prevents the outflow of closure resin 3, a frame 8 suppresses escaping outside, and the force of joining closure resin 3 can boil resin seal nature markedly, and can improve. Moreover, it can suppress that a void occurs inside closure resin 3 by performing a resin seal in a reduced pressure ambient atmosphere.

[0039] Furthermore, it becomes possible by pressing closure resin 3 to the height of a frame 8 to control the thickness of closure resin 3 by the height of a frame 8 to homogeneity about two or more chips 6.

[0040] Furthermore, the mechanical strength of the base substrate section 7 increases by forming a frame 8 in the periphery of the base substrate section 7. Therefore, thickness of the base substrate section 7 can be made thin. For example, by forming a frame 8 in the periphery of the ceramic substrate 7, degradation of the ceramic substrate 7 by becoming thin on the strength can be reinforced, and it can contribute to low back-ization of surface acoustic wave equipment. Moreover, what has the thinner thickness of the base substrate 7 can be used.

[0041] Furthermore, internal observation becomes easy in case a chip, **, etc. is inspected when closure resin 3 uses a transparent and colorless thing, or failure analysis is performed.

[0042] As mentioned above, although the gestalt of one operation indicated this invention, if this invention is limited, he should not understand the statement and the drawing which make a part of this indication. The gestalt, example, and employment technique of various alternative implementation will become clear to this contractor from this indication.

[0043] With the gestalt of operation of this invention, the multiple picking base substrate which consists of the base substrate section 7 and a frame 8 was prepared first, and the chip 6 was connected inside the frame 8 after that. However, this invention is not limited to this. A chip 6 may be first connected to the base substrate section 7 to which the frame 8 is not connected, and a frame 8 may be connected to the outside of a chip 6 after that. That is, the sequence of connecting a chip 6 and a frame 8 to the base substrate section 7 may perform whichever first.

[0044] Moreover, although the case where the closure resin 3 whole was transparent and colorless was explained, some closure resin 3 may be used as a transparent layer.

[0045] Moreover, what [not only] divided the base substrate section 7 and a frame 8 but the multiple picking base substrate with which they were formed in one may be used for a multiple picking base substrate (7 8).

[0046] As mentioned above, although explained taking the case of surface acoustic wave equipment as electronic-parts equipment, this invention is applicable similarly in the electronic-parts equipment which uses a resin seal.

[0047] Thus, he should understand that this invention includes the gestalt of various operations which have not been indicated here etc. Therefore, this invention is limited by only the invention specification matter which starts an appropriate claim from this indication.

[0048]

[Effect of the Invention] As explained above, according to this invention, the manufacture approach of surface acoustic wave equipment with the high

dependability of a resin seal package and a multiple picking base substrate can be offered.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] Drawing 1 (a) is the transparency perspective view showing the surface acoustic wave equipment concerning the gestalt of operation of this invention. Drawing 1 (b) is the sectional view of the surface acoustic wave equipment in alignment with the A-A' cutting plane of drawing 1 R> 1 (a).

[Drawing 2] Drawing 2 (a) thru/or (c) are the process sectional views showing the manufacture approach of the surface acoustic wave equipment concerning the gestalt of operation of this invention (the 1).

[Drawing 3] Drawing 3 (a) is the sectional view showing one production process in the manufacture approach of the surface acoustic wave equipment concerning the gestalt of operation of this invention. Drawing 3 (b) is a sectional view in alignment with the B-B' cutting plane of **.

[Drawing 4] Drawing 4 (a) and (b) are the process sectional views showing the manufacture approach of the surface acoustic wave equipment concerning the

gestalt of operation of this invention (the 2).

[Drawing 5] Drawing 5 (a) is the sectional view showing one production process in the manufacture approach of the surface acoustic wave equipment concerning the conventional technique. Drawing 5 R> 5 (b) is a sectional view in alignment with the C-C' cutting plane of **.

[Description of Notations]

1 Piezoelectric Substrate

2 Projection Electrode

3 Closure Resin

4 Seven Base substrate section

5 Ctenidium Electrode

6 Chip

8 Frame

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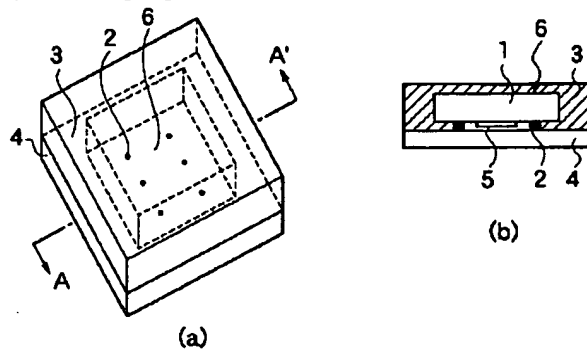
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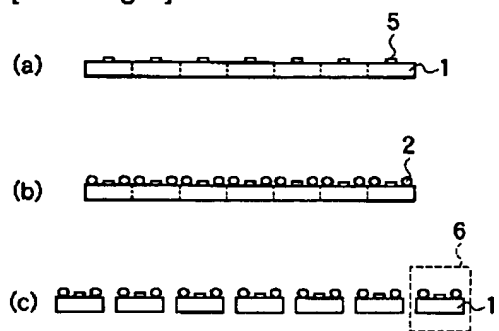
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DRAWINGS

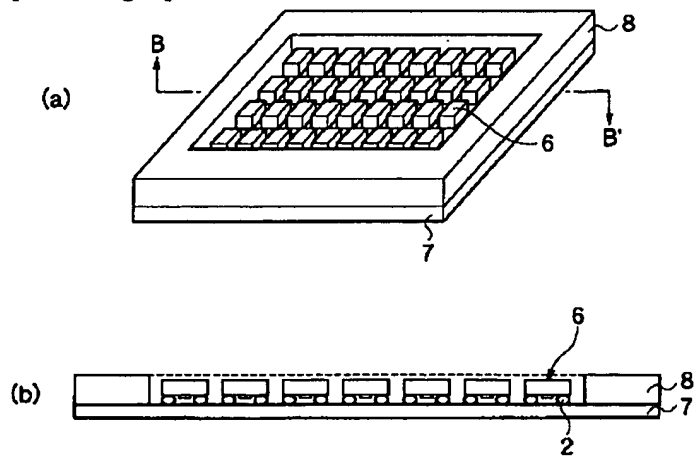
[Drawing 1]



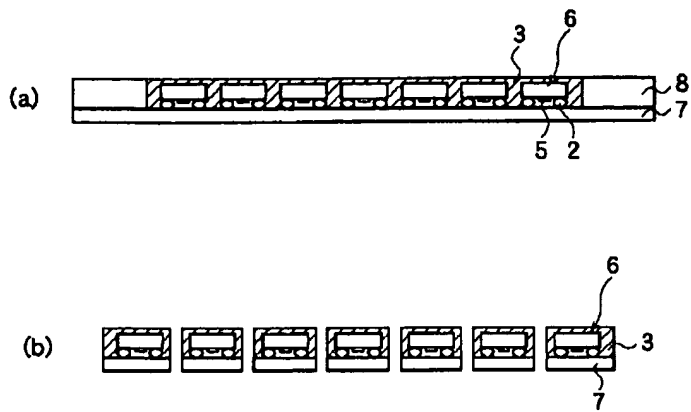
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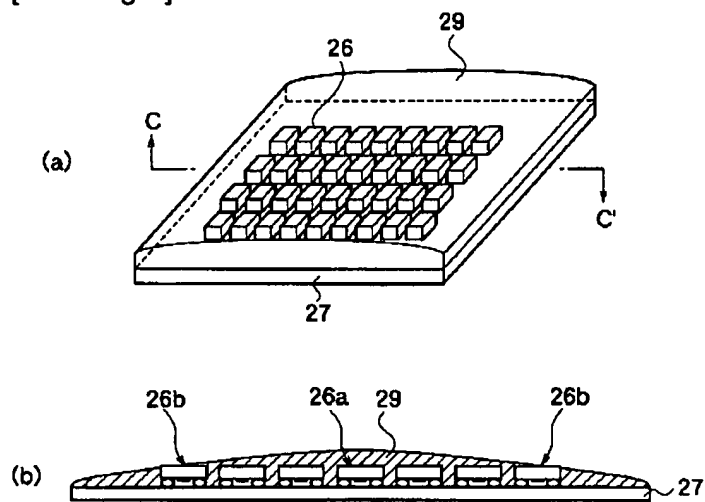
[Drawing 3]



[Drawing 4]



[Drawing 5]



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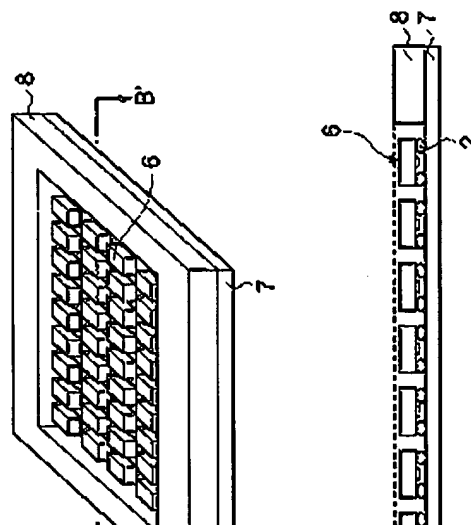
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(54) 【発明の名称】 弾性表面波装置の製造方法及び多面取りベース基板

(57) 【要約】

【課題】 樹脂封止パッケージの信頼性が高い弾性表面波装置の製造方法を提供する。

【解決手段】 弾性表面波素子が形成された複数のチップを用意し、複数のチップを平板状のベース基板部の主表面上に電気的及び機械的に接続し、ベース基板部の主表面上に、複数のチップの周囲を取り囲むリング状の枠を配置し、流動性を有する封止樹脂で複数のチップを封止し、封止樹脂及びベース基板部をチップ毎に個片化する。



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【特許請求の範囲】

【請求項1】 弾性表面波素子が形成された複数のチップを用意し、

前記複数のチップを、平板状のベース基板部の主表面上に電気的及び機械的に接続し、

前記ベース基板部の主表面上に、前記複数のチップの周囲を取り囲むリング状の枠を配置し、

流動性を有する封止樹脂で前記複数のチップを封止し、前記封止樹脂及び前記ベース基板部を前記チップ毎に個片化することを特徴とする弾性表面波装置の製造方法。

【請求項2】 弾性表面波素子が形成された複数のチップを用意し、

平板状のベース基板部と当該ベース基板部の主表面上に配置されたリング状の枠とを有する多面取りベース基板を用意し、

前記複数のチップを、前記枠の内側の前記ベース基板部の前記主表面上に電気的及び機械的に接続し、

流動性を有する封止樹脂で前記複数のチップを封止し、前記封止樹脂及び前記ベース基板部を前記チップ毎に個片化することを特徴とする弾性表面波装置の製造方法。

【請求項3】 前記枠の内周は、最外周の前記チップの端からチップ1つ分外側までの間に配置されていることを特徴とする請求項1及び請求項2いずれか1項記載の弾性表面波装置の製造方法。

【請求項4】 前記枠の高さは、前記ベース基板部に接続された前記チップの高さより50 μ m以上高いことを特徴とする請求項1及び請求項2いずれか1項記載の弾性表面波装置の製造方法。

【請求項5】 前記封止樹脂及び前記ベース基板部を前記チップ毎に個片化することは、前記封止樹脂及び前記ベース基板部をかみそり状の刃を用いて打ち抜くことであることを特徴とする請求項1及び請求項2いずれか1項記載の弾性表面波装置の製造方法。

【請求項6】 減圧雰囲気において、前記複数のチップを封止することを特徴とする請求項1及び請求項2いずれか1項記載の弾性表面波装置の製造方法。

【請求項7】 前記封止樹脂は少なくとも一部に透明な層を有することを特徴とする請求項1及び請求項2いずれか1項記載の弾性表面波装置の製造方法。

【請求項8】 弾性表面波素子が形成された複数のチップが電気的及び機械的に接続される平板状のベース基板部と、

当該ベース基板部の主表面上に配置された、前記複数のチップの周囲を取り囲むリング状の枠とを有することを

特徴とする弾性表面波装置の製造方法。

を用いた弾性表面波装置の製造方法に関する。

【0002】

【従来の技術】近年、電波を使用する電子機器内のフィルタ、遅延線、発振器等の素子として、弾性表面波装置が幅広く用いられている。移動体通信等の分野においては、使用される電子機器の小型化及び高信頼性化が要求され、弾性表面波装置に対しても同様な要求がある。

【0003】この小型化の要求に答えるべく、従来の弾性表面波装置はフリップチップボンディング構造及び樹脂封止構造を採用する。また、生産効率などの観点から、1つのベース基板上に複数のチップをボンディングし、同時に樹脂封止する製造方法を採用している。

【0004】図5(a)に示すように、弾性表面波素子が形成された複数のチップ26を、バンプを介して多面取りのベース基板27の上に電気的及び機械的に接続する。そして、流動性を有するシート状の封止樹脂29を複数のチップ26に押し当てることで、複数のチップ26を封止樹脂29によって同時に封止する。熱を加えて硬化させた封止樹脂29及び多面取りのベース基板27を個片化することで、弾性表面波装置が製造される。

【0005】

【発明が解決しようとする課題】上記方法により製造された表面弾性波装置は安価で大量生産に言いが、樹脂封止パッケージの信頼性が低く、封止不良の発生率が高いという問題を有している。

【0006】封止樹脂29は流動性を有するため、熱硬化させる前に多面取りベース基板27の外周から封止樹脂29の一部が流れ落ちてしまう。即ち、図5(b)に示すように、多面取りベース基板27の中央に位置するチップ26aの上には十分な樹脂29が留まっている。しかし、最外周に位置するチップ26bの上には、留まるはずの樹脂29が多面取りベース基板27から流れ落ちてしまう。よって、多面取りベース基板27の外周部に形成される封止樹脂29の厚みは、中央部のそれと比べて薄くなってしまふ。更に、最外周に位置するチップ26bの上部が一部露出してしまふ場合もある。

【0007】本発明はこのような従来技術の問題点を解決するために成されたものであり、その目的は、樹脂封止パッケージの信頼性が高い弾性表面波装置の製造方法及び多面取りベース基板を提供することである。

【0008】

【課題を解決するための手段】上記目的を達成するため、本発明の第1の特徴は、弾性表面波素子が形成された複数のチップを、多面取りのベース基板上に配置し、当該ベース基板部の主表面上に配置された、前記複数のチップの周囲を取り囲むリング状の枠とを有することを

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るためである。

【００１６】本発明の第３の特徴は、弾性表面波素子が形成された複数のチップが電氣的及び機械的に接続される平板状のベース基板部と、ベース基板部の主表面上に配置された、複数のチップの周囲を取り囲むリング状の枠とを有する多面取りベース基板であることである。

[0017]

【発明の実施の形態】以下図面を参照して、本発明の実施の形態を説明する。図面の記載において同一あるいは類似部分には同一あるいは類似な符号を付している。ただし、図面は模式的なものであり、層の厚みと幅との関係、各層の厚みの比率などは現実のものとは異なることに留意すべきである。また、図面の相互間においても互いの寸法の関係や比率が異なる部分が含まれていることはもちろんである。

【００１８】図１（ａ）に示すように、本発明の実施の形態に係る弾性表面波装置は、平板状のベース基板部４と、平板状のベース基板部４の上方に配置された、少なくとも隣接電極５を有するチップ６と、チップ６を封止する封止樹脂３と、ベース基板部４とチップ６の間を電気的及び機械的に接続する複数の突起電極２とを有する。チップ６はベース基板４のほぼ中央に配置されている。

【0019】図1(a)のA-A'断面で切断した切断面の図1(b)に示すように、突起電極2は、ベース基板部4とチップ6との間に配置され、両者を接続している。封止樹脂3は、チップ6の上面のみに限らず、その側面にも配置されている。

【0020】封止樹脂3は、チップ6を環境ストレス及び機械的ストレスから保護する機能を有する。例えば、封止樹脂3として、ポリイミド樹脂、PP/EPR系ポリマーアロイ（PP/Ethylene Propylene Rubber Blend）、TEX（京燃化学株式会社製、ポリオレフィン系TPE（Polyolefine Thermoplastic Elastomer））、タブレン（旭化成株式会社製、SBS（Styrene-Butadiene-Styrene Block Copolymer））、マクスロイA（日本合成ゴム株式会社製）、X-9（ユニチカ株式会社製、PA/PAR（PA/Polyarylate））、テナック（旭化成株式会社製、POM/TPU（POM/Thermoplastic Polyurethane））などの高分子系材料を使用することができる。実施の形態においては、封止樹脂3として無色透明の樹脂を使用する。

【0021】ベース基板部4として、セラミックス基板、或いはビスマレイミド・トリアジン、ポリイミド（BTエポキシ）、ポリイミド、ポリフッ素イミド等を用

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【0013】更に、封止樹脂及びベース基板部をチップ毎に個片化することは、封止樹脂及びベース基板部をかみそり状の刃を用いて打ち抜くことであることが望ましい。これは、封止樹脂及びベース基板も精度良く、且つチップに余分な応力を加えることなく切断、個片化することが可能となるからである。

【0014】更に、減圧雰囲気において、複数のチップを封止することが望ましい。これは、ボイドの発生を防止すると共に、封止後にチップとベース基板の間に形成される空間部を減圧雰囲気で封止できるため十分な封止が得られる。また、チップの特性変化を防止することが可能となる。

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ス基板部4の厚みは、必要な強度を有するものであれば何ら特定されるものではないが、100乃至200 μ mであることが望ましい。実施の形態においては、ベース基板部4として、厚さ180 μ mのBTレジンなら成るフレキシブル基板を使用する。

【0022】チップ6には、圧電性基板1と、圧電性基板1の主面上に形成された櫛歯電極5を含む金属膜パターンとを有する弾性表面波素子が形成されている。また、金属膜パターンは圧電性基板1のベース基板部4に対向する主面上に形成されている。即ち、弾性表面波装置はフリップチップボンディング構造を有する。櫛歯電極5は、図示は省略するが、互いに噛み合う2以上の櫛歯状の平面形状を有する金属電極である。弾性表面波(SAW)は、櫛歯電極5によって励振及び検出される。櫛歯電極5の入力インターデジタルトランスジューサに電気信号を印加し、これを弾性表面波に変換して圧電性基板1の上を伝達させる。さらにもう1つの櫛歯電極5の出力インターデジタルトランスジューサに到達した弾性表面波は再度電気信号に変換されて外部に取り出すことができる。櫛歯電極5の材料となる金属は、例えばAl(アルミニウム)あるいはAlを主成分とする合金からなる。後者の場合、添加物として銅(Cu)、シリコン(Si)等を使用できる。なお、金属膜パターンには、櫛歯電極5の他に、突起電極2に接続される電極パッド、及び弾性表面波を反射する為の反射器などが含まれる。

【0023】入力インターデジタルトランスジューサに印加される電気信号、及び出力インターデジタルトランスジューサによって再度電気信号に変換された電気信号は、それぞれ突起電極2を介してベース基板部4から入力され、或いはベース基板部4へ出力される。図示は省略したが、ベース基板部4の裏面にも互いに接続された配線が形成され、電気信号の送受信がこの配線を介して行われる。また、櫛歯電極5の周囲には封止樹脂3は配置されていない。櫛歯電極5が形成されたチップ6のアクティブエリアには中空領域が形成されている。これは、櫛歯電極5による弾性表面波の励振及び検出、及び弾性表面波の圧電性基板1上の伝播を正常に行い得るようにする為である。

【0024】圧電性基板1として、タンタル酸リチウム(LiTaO₃)、ニオブ酸リチウム(LiNbO₃)、バリウム酸リチウム基板(LiBaO₃)、サファイア、或いはクォーツ(SiO₂)などからなる単結晶基板を使用することができる。若しくは、これらの

ることができる。

【0026】(イ)まず、図2(a)に示すように、ウェハ状の圧電性基板1の上に膜厚数百nm程度の金属膜を成膜する。この金属膜の上にレジスト膜を形成し、フォトリソグラフィ法でレジスト膜を露光・現像する。そして、このレジスト膜をマスクとして金属膜を反応性イオンエッチング(RIE)法で選択的にエッチングし、櫛歯電極5を含む金属膜パターンを形成する。金属膜の成膜は、金属蒸着法、スパッタリング法、化学的気相成長(CVD)法を使用することができる。

【0027】(ロ)次に、図2(b)に示すように、金属膜パターンの電極パッドの上に、パンプボンディング装置を用いて突起電極2を形成する。

【0028】(ハ)次に、図2(c)に示すように、ダイシング装置を用いてウェハ状の圧電性基板1を弾性表面波素子ごとに切断、即ち個片化して、複数のチップ6を製造する。

【0029】(ニ)次に、図3(a)及び図3(a)のB-B'断面で切断した切断面の図3(b)に示すように、多数個取りベース基板(7、8)を用意する。多数個取りベース基板(7、8)は、複数のチップ6が電気的及び機械的に接続される平板状のベース基板部7と、ベース基板部7の主表面上に配置された、複数のチップ6の周囲を取り囲むリング状の枠8とを有する。ここで、「ベース基板部7」は弾性表面波装置を多数個取る為の基板を示し、図1(a)及び(b)に示した複数の「ベース基板部4」が連続して一体形成されているものである。したがって、厚み及び材料はベース基板部4と同じである。

【0030】枠8の内周は、最外周のチップ6の端(複数のチップ6の実装エリア)から外側へ1mm離れた場所に配置されている。枠8の内周は、最外周のチップ6の端からチップ1つ分外側までの間に配置されていることが望ましい。枠8の高さは500 μ mであり、幅は10mmである。多数個取りベース基板(7、8)は、ベース基板部7と枠8とを積層して接合することにより作成される。

【0031】(ホ)次に、フリップチップボンディング装置を用いて、複数のチップ6を多面取りベース基板(7、8)の上に突起電極2を介して接続する。ここでは、約400個のチップ6を1つの多面取りベース基板(7、8)の上に接続する。具体的には、チップ6をベース基板部7の主表面へ所定の圧力で押し当てると同時に、突起電極2及びベース基板部7に超音波を印加する

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望ましい。なお前述したように、最外周のチップ6は、枠8の内周から内側へ1mm離れた場所に配置されている。

【0032】(へ)次に、図4(a)に示すように、減圧雰囲気において、流動性を有する封止樹脂3で複数のチップ6を同時に封止する。具体的には、シート状の封止樹脂3をチップ6の上に配置する。そして、封止樹脂3とベース基板部7とを挟むように力を加え、同時に封止樹脂3に熱を加える。隣接するチップ6の隙間に封止樹脂3が入り込み、チップ6の上にのみならず、その側面をも封止樹脂3によって覆い囲むことができる。封止樹脂3は熱硬化成分を含有するため、加えられた熱により硬化する。このようにして、複数のチップ6を封止樹脂3によって同時に封止することができる。

【0033】なお、シート状の封止樹脂3は、チップ6の実装エリアの大きさではなく、枠8の上部にかかる程度の大きさであると、封止後のチップ6側面のボイドの発生をより防止することが可能となり、好ましい。

【0034】ここで、封止樹脂3は接着性を有する。枠8の高さ(500μm)まで封止樹脂3を所定の金型を用いてプレスすることにより、封止樹脂3の高さを総てのチップ6について均一な500μmにすることができる。したがって、ベース基板部7及び封止樹脂3の全体厚みは680μmとなる。

【0035】上記例においては、封止処理前の封止樹脂3として、シート状のものを使用した。これに限らず、流動性のある樹脂を枠8内全体に配置後、スキージ等で上面を例えば枠8の高さに合わせて均一にしたのち、硬化して、複数のチップ6を封止樹脂3によって同時に封止することも可能である。

【0036】(ト)最後に、図4(b)に示すように、ベース基板部7及び封止樹脂3をチップ6ごとに個片化する。ここでは、かみそり状の刃を封止樹脂3或いはベース基板部7に押し当ててプレスにより打ち抜くことによって個片化する。勿論、回転歯(ダイシングブレード)を用いてダイシングしても構わない。以上の手順を経て、図1(a)及び(b)に示した弾性表面波装置を製造することができる。

【0037】以上説明したように、本発明の実施の形態によれば、枠8は、封止樹脂3がベース基板部7から流れ落ちることを抑えることができる。よって、最外周に位置するチップ6の上部に形成される封止樹脂3の厚さを、中央に位置するチップ6のそれと同等に維持することができる。

【0038】次に、図5(a)に示すように、ベース基板部7の最外周に枠8を設けることにより、封止樹脂3の厚みを枠8の高さによって複数のチップ6について均一に制御することが可能となる。

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【0039】更に、封止樹脂3を枠8の高さまでプレスすることにより、封止樹脂3の厚みを枠8の高さによって複数のチップ6について均一に制御することが可能となる。

【0040】また更に、ベース基板部7の外周に枠8を設けることでベース基板部7の機械的強度が増す。よって、ベース基板部7の厚さを薄くすることができる。例えば、セラミックス基板7の周辺部に枠8を設けることにより、薄くなることによるセラミックス基板7の強度劣化を補強することができ、弾性表面波装置の低背化に寄与することができる。また、ベース基板7の厚さがより薄いものを使用することができる。

【0041】また更に、封止樹脂3が無色透明のものを使用することにより、チップかけ等を検査したり、不良解析を行う際に、内部観察が容易となる。

【0042】上記のように、本発明は、1つの実施の形態によって記載したが、この開示の一部をなす論述及び図面はこの発明を限定するものであると理解すべきではない。この開示から当業者には様々な代替実施の形態、実施例及び運用技術が明らかとなる。

【0043】本発明の実施の形態では、まず、ベース基板部7及び枠8から成る多面取りベース基板を用意し、その後、枠8の内側にチップ6を接続した。しかし、本発明はこれに限定されるものではない。枠8が接続されていないベース基板部7にチップ6をまず接続し、その後、チップ6の外側に枠8を接続しても構わない。即ち、ベース基板部7へチップ6及び枠8を接続する順番はどちらを先に行っても構わない。

【0044】また、封止樹脂3全体が無色透明な場合について説明したが、封止樹脂3の一部を透明な層にしても構わない。

【0045】また、多面取りベース基板(7、8)は、ベース基板部7と枠8は分割したもののだけでなく、それらが一体的に形成された多面取りベース基板を用いても構わない。

【0046】以上、電子部品装置として弾性表面波装置を例に取り説明したが、本発明は、樹脂封止を用いる電子部品装置においても同様に適用することが出来る。

【0047】このように、本発明はここでは記載していない様々な実施の形態等を包含するということを理解すべきである。したがって、本発明はこの開示から妥当な特許請求の範囲に係る発明特定事項によってのみ限定されるものである。

【0048】

【0049】

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表面波装置を示す透過斜視図である。図1(b)は、図1(a)のA-A'切断面に沿った弾性表面波装置の断面図である。

【図2】図2(a)乃至(c)は、本発明の実施の形態に係る弾性表面波装置の製造方法を示す工程断面図である(その1)。

【図3】図3(a)は、本発明の実施の形態に係る弾性表面波装置の製造方法における一製造工程を示す断面図である。図3(b)は、のB-B'切断面に沿った断面図である。

【図4】図4(a)及び(b)は、本発明の実施の形態に係る弾性表面波装置の製造方法を示す工程断面図であ*

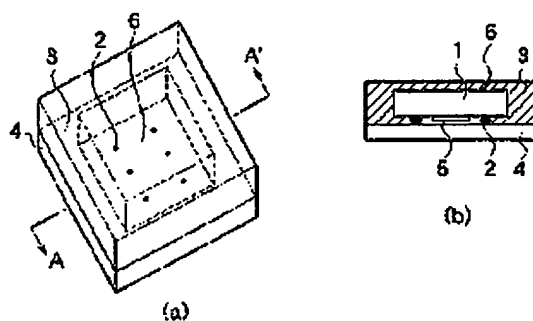
*る(その2)。

【図5】図5(a)は、従来技術に係る弾性表面波装置の製造方法における一製造工程を示す断面図である。図5(b)は、のC-C'切断面に沿った断面図である。

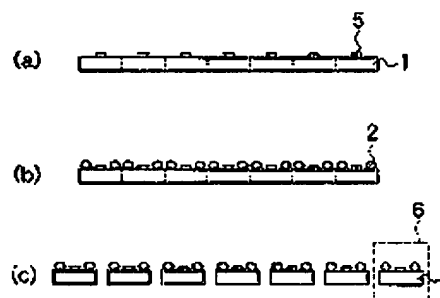
【符号の説明】

- 1 圧電性基板
- 2 突起電極
- 3 封止樹脂
- 4, 7 ベース基板部
- 5 歯状電極
- 6 チップ
- 8 枠

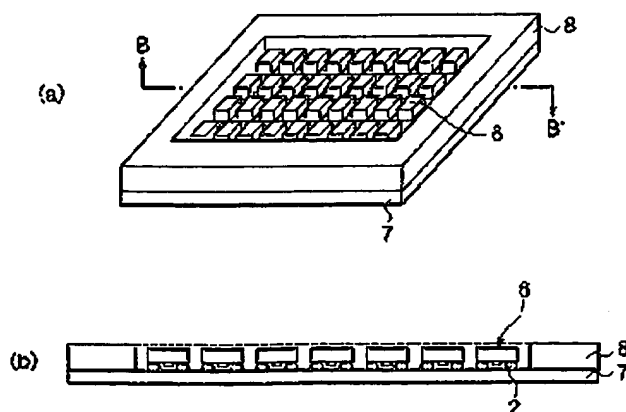
【図1】



【図2】



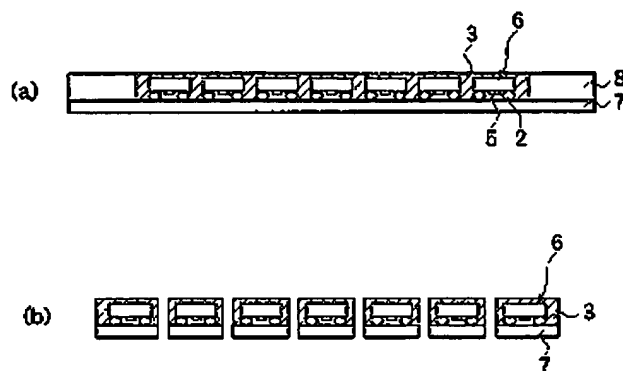
【図3】



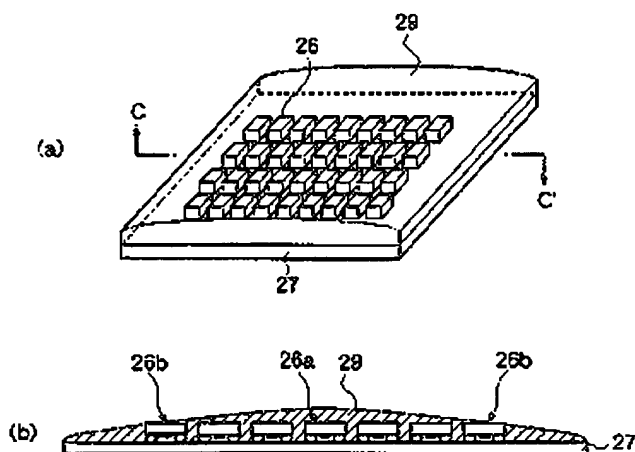
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【図4】



【図5】



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 5J097 AA24 AA32 FF03 GG03 GG04
 HA07 HA08 JJ03 JJ09 KK10
 LL08